HP-HT metasomatic garnetite associated with lherzolite complexes in the Urals: An indicator of timing of mantle upwelling and exhumation

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Geological Background

The lherzolite allochthons situated in the Main Uralian Fault zone (MUF) (Southern Urals, Russia) are accompanied by serpentine mélange comprising blocks of different high pressure garnet-bearing rocks [1, 2, 3]. Garnetites are a rare example of HP rocks in the mélange. They consist of 80-90% of high-Ca almandine-pyrope garnet, high-Al pargasite and contain a lot of zircon, Zr-rutile, ilmenite and apatite. The garnetites are enriched in LREE, Zr, Sr, Ba, Nb, and we suppose their metasomatic origin. Rutile contains high amount of Zr up to 0.4% that reflects a high temperature origin (T>800ºC) of mineral and rock respectively. Small inclusions of srilankite, ilmenite and uraninite have been found in rutile. During the exhumation and rodingitization, zircon was replaced by baddeleyite. The different type of mineral-geochronometers allows determine the age evolution of garnetite from the HP-HT conditions up to LP rodingitization

Discussion of Results

The earlier HP-HT-stage of garnetite formation took place probably at 440 Ma and it was indicated by crystallization of magmatic zircon and Zr-rutile which had captured Ba and Sr-rich phases. These event was related with upwelling of hot mantle material through the slab-window which had been formed at the end of Ordovician subdaction in the Southern Urals. The next important event corresponds to 425-405 Ma [2, 3] time interval and reflects an exhumation process of HP rocks. Low pressure transformations of garnetite start at 400 Ma (zircon rims) and continuer up to 375-360 Ma (late rutile and baddeleyite formation) when MUF structure was closed and huge ophiolite allochthons were formed.

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